



Provisional Guidance on Transcribing Mathematics in UEB

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1. Introduction

The following guidelines, intended for use in the US and Canada, supplement the rules and guidance presented in the international publications *Rules of Unified English Braille, 2013* (RUEB) and *Unified English Braille Guidelines for Technical Material* (GTM) authorized by the International Council on English Braille (ICEB). The purpose of this document is to provide additional clarification and practical suggestions for the transcription of "technical" (that is, mathematics and science) texts transcribed using Unified English Braille, so as to achieve a reasonable level of standard transcription. The examples and some of the language used in this document are from the UK Association for Accessible Formats (UKAAF) document, "Additional Guidance for UEB Mathematics" and are used with permission.

These guidelines primarily apply to UEB math braille transcriptions, particularly for materials that would benefit from consistent practice such as standardized tests or transcriptions created without information about the classroom or student. Different approaches may be needed in classroom practice, (e.g., in regard to the spacing of signs for beginning learners, as noted in GTM 1.1.2), and the presentation of spatial problems for instructional purposes. Similarly, the guidelines stated here, such as the spacing of signs or the choice of grade 1 indicators, would not necessarily be applied in non-mathematical contexts. (See, for example, RUEB 11.2.1.) As is BANA's practice, outlined in the BANA *Formats* guidelines, a transcriber's note may be needed to let the reader know when print formats are not followed; general readability and clarity of presentation take precedence.

In this document the word "expression" signifies any group of mathematical symbols. It may be a single term or a longer group of mathematical symbols, such as an equation, which is not broken by ordinary text.

2. Spacing of signs (RUEB 11.2.2; GTM 1.1)

Follow the general rule to leave a space on either side of comparison or relation signs and place operation signs unspaced from their adjacent terms. However, the GTM allows spaces around signs of operation for beginning readers, so follow agency decision about how signs are presented.

Example:

$$6 = 1 \times 2 \times 3 = 1 + 2 + 3$$

3. General format (GTM 1.4.1)

For technical materials, use margins 3-1; do not use blocked paragraphs. If the entire textbook is in blocked paragraphs, note the change to indented paragraphs in a TN.

Follow *Braille Formats: Principles of Print-to-Braille Transcription, 2016* for the format of displayed literary text except for paragraph format, which is never blocked. For displayed mathematical expressions, use blank lines preceding and following; and indent 2 cells from the runover position of the material to which they apply.

Use of the full braille line for a displayed technical expression (with runovers in cell 3), is appropriate for higher math where expressions are lengthy and more complicated. The spaces used to indent beyond the runover in effect can make the difference between dividing or keeping a mathematical unit together.

For directions preceding itemized materials, use margins 5-5. If there are additional paragraphs, use margins 7-5. For directive sentences that precede material that is not itemized use margins 3-1.

Treat an exercise with subentries as a nested list and the indentation pattern is determined by the complete set, not individually. For example, if two levels: 1-5, 3-5; if three levels: 1-7, 3-7, 5-7, and so forth.

Keep abbreviations on a braille line with the numbers to which they apply.

4. Dividing mathematics expressions over braille lines (GTM 1.4.1-3)

As stated in the GTM, when a mathematical expression cannot be kept on one braille line, the choice of a line break site should follow mathematical structure:

- before comparison signs

- before operation signs (unless they are within one of the mathematical units below)
- before a mathematical unit such as:
 - fractions (and within the fraction consider the numerator and denominator as units)
 - functions
 - radicals
 - items with modifiers such as superscripts or bars
 - shapes or arrows
 - anything enclosed in print or braille grouping symbols
 - a number and its abbreviation or coordinates

Usually the best place to divide an expression is before a comparison sign or operation sign. Breaking an expression between braille pages should be avoided.

If you make reasonable divisions following the above guidance, the dot 5 continuation indicator mentioned in GTM 1.4 will not often be needed; the meaning or format should make it clear enough that the expression on the new line is a continuation of that on the previous line, e.g. it will typically start with a comparison or operation sign.

5. Guidance on grade 1 indicators with mathematics expressions (RUEB 5.9; GTM 1.7)

Because the numeric indicator also begins Grade 1 mode, there will often be cases where no grade 1 indicators are required in a math or science expression. In addition, the UEB rules allow different approaches for the use of grade 1 indicators, and so several approaches can be equally correct.

As explained in the introduction, the purpose of the following guideline is to present a standardized method, though it does not invalidate other approaches.

If grade 1 indicators are required, the basic principle to follow is:

Unless a math expression can be correctly represented with only a grade 1 symbol indicator in the first three cells or before a single

letter standing alone anywhere in the expression, begin the expression with a grade 1 word indicator (or a passage indicator if the expression includes spaces).

The result of this principle is that grade 1 symbol indicators within the math expressions are largely avoided. Of course, there are cases where a grade 1 indicator is essential at a particular point, notably where a letter a-j immediately follows a number. This prevents it from being read as a digit. The above rule does not apply to such cases where there is no option to avoid the use of the grade 1 indicator.

Note that, in the case of an expression that is divided over more than one line, the end of a braille line counts as a braille space unless the dot 5 continuation indicator is used. Remember that, “standing alone” is used according to the standard UEB definition in RUEB 2.6 and includes various cases where a letter adjoins brackets or punctuation.

Examples:

$$x + y = 6$$

(No grade 1 indicators needed.)

$$x^2 + y^2 = C$$

(Grade 1 indicator is in first 3 cells and before a letter standing alone.)

$$\frac{a}{b} + \frac{c}{d}$$

[illegible]

(Unspaced expression; grade 1 word indicator needed because otherwise the expression would be interrupted with a grade 1 indicator before the three remaining general fraction indicators.)

$$a^n \times a^m = a^{n+m}$$

(Spaced expression; grade 1 passage indicator needed.)

$\log_x y$

suggest a more consistent approach to transcription and improve the readability of mathematics expressions.

6. Additional guidance on grade 1 indicators

Where grade 1 passage indicators are used around a math expression, punctuation at the end of the expression (e.g. a period at the end of a sentence) should normally be included before the grade 1 terminator, even though not part of the expression itself.

Example:

$$x + y = z = t^2.$$

If there is more than one separate math expression (e.g. several equations), following one after the other, the grade 1 passage indicators can be used. In that case, the whole group can be enclosed in passage indicators rather than using separate indicators for each item. Intervening punctuation would be included within the passage indicators. However, text would not ordinarily be included because the words would be uncontracted. Generally, the numeric passage would be terminated before the words and a new passage mode would be added at the beginning of the next set of math expressions.

Note that a grade 1 passage continues onto a new braille page until the passage terminator; if an expression is split over braille pages you do not need to restart the passage indicator on the new page.

7. Numbered Equations

Equation numbers should be placed before the equation in braille, and be separated from it by a single space, even if they appear on the right in print. A transcriber's note should be included to explain this change from print.

8. Ellipses

Where print uses four or more dots for an ellipsis without special reason, as in expressions for series or sets, for consistency use only 3 unspaced periods (dots 256).

9. Spatial problems

Several display options are allowed in UEB for spatial math problems. (See GTM 4.) Some of these options do not match the print shown in textbooks but may provide easier understanding of mathematical procedures and concepts for young braille readers. These methods are suitable for instructional purposes. However, for the sake of consistency in standardized test situations, follow print formatting of spatial problems.

An exception to this guideline can be made if the transcribing agency is requested to use a specific format by the state's educational system to match a state mandated math curriculum, especially for younger learners who may have limited experience with various presentation styles.